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Patient-Reported Recovery After Abdominal and Pelvic Surgery Using the Convalescence and Recovery Evaluation (CARE): Implications for Measuring the Impact of Surgical Processes of Care and Innovation

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Abstract

Background—Recovery is an integral part of the surgical process and measuring it provides insight into the impact of surgical innovation. This study used a recently validated instrument, the Convalescence and Recovery Evaluation (CARE), to measure return to baseline health after surgery and explore clinical factors associated with recovery.

Study design—Patient health was measured among 96 patients before and after abdominal and pelvic surgery. Patients were grouped by time to recovery of 90% of baseline status. χ^2 Tests and logistic models were used to measure relationships between recovery time and patient characteristics, processes of care, and outcomes.

Results—Return to baseline health was reached by 44% of patients within 2 weeks, 28% between 2 and 4 weeks, and 28% after 4 weeks. Patients who recovered faster were younger, female, single, and undergoing ambulatory surgery for benign diseases. Patients who were married, underwent surgery for cancer, or had bowel surgery were more likely to require longer recovery time.

Conclusions—Several patient and clinical characteristics were found to be associated with recovery after surgery. CARE appears to be sensitive to these factors and may be useful for informed decision making, assessing changes in processes of care, and evaluating the impact of surgical innovations on recovery.

Keywords

surgery; quality of life; convalescence; outcome assessment (health care)

Surgical success has traditionally been measured in the context of disease status, morbidity, and mortality. For some procedures, including cancer resections and cardiac bypass surgery, these outcomes may be aligned with those most important to the patient. However, for many discretionary procedures, these traditional metrics fall short of accurately characterizing the most relevant issues to the patient. In such cases, reliably ascertaining symptom resolution may be the most important result, and measuring quality of life using psychometrically valid instruments represents a central facet of surgical quality.¹

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However, generic patient-reported instruments for ascertaining recovery of health status after surgery have been lacking. In most cases, such measures have been tailored to assessing constructs germane to particular disease states² or following specific procedures.³ Thus, physician-reported outcomes, whether or not captured systemically, have been used historically to counsel patients and set expectations about recovery.⁴ The discrepancies between physician and patient assessments of quality of life⁵ underscore the need for generic measures to better inform both parties about expectations after surgery.

For this reason, we undertook a study to better understand the usefulness of a generic, validated instrument to measure recovery after abdominal and pelvic surgery. For this purpose, we used the Convalescence and Recovery Evaluation (CARE), a self-administered questionnaire validated for measuring health status following surgery.⁶ For CARE to be useful for setting expectations about recovery, it must be sensitive to constructs that potentially mediate the process. Thus, the focus of this study is to evaluate the responsiveness of CARE to patient differences as a function of recovery.

Methods

Study Subjects

Subjects for this pilot study were accrued at the University of Michigan Medical Center as a convenience sample of 96 patients undergoing urologic (n = 35), general (n = 29), or gynecologic (n = 32) surgery. Patients were consented in the preoperative clinic of each specialty and agreed to complete both preoperative and a series of regularly timed postoperative questionnaires. Information on patient demographic characteristics was obtained at study entry and patients were then followed prospectively. The group was recruited to represent the breadth and complexity of procedures performed in each specialty. Common urology procedures included radical prostatectomy (n = 11), radical cystectomy and urinary diversion (n = 9), and partial or radical nephrectomy (n = 9). Common general surgery procedures included bowel resection (n = 14), various hernia repairs (n = 5), and adrenalectomy (n = 3). Common gynecology procedures included hysterectomy (n = 9), laparoscopy ± ablation/excision/lysis (n = 9), myomectomy (n = 6), and incontinence-related surgery (n = 5).

Measurement of Patient-Reported Recovery After Surgery

Patient-reported recovery was measured using CARE, a multidimensional instrument used to assess health status after abdominal and pelvic surgery.⁶ CARE consists of 27 items and measures health in 4 dimensions that are common to recovery after abdominal surgery, including pain, gastrointestinal symptoms, cognition, and activity. Domain scores range from 0 to 100, with higher scores corresponding to a better health state, and can be combined to generate a composite score. Questionnaires were administered preoperatively and at 1, 2, 4, 6, and 12 weeks postoperatively. The preoperative questionnaire was self-administered at the time of the preoperative visit and all other questionnaires were completed and returned by mail. CARE has demonstrated excellent psychometrics with good internal consistency (Cronbach's $\alpha = .94$) and test-retest reliability (94%).⁶

For this study, return to baseline health status after surgery was the primary outcome and was measured at the patient level. Based on prior work, recovery was considered complete when a patient achieved 90% of their preoperative composite score.^{7,8} Because the intervals for postoperative follow-up were discretely defined by the timing of questionnaire administration, patients were grouped according to when they achieved this threshold: those who took 2 weeks or less (early), those who took more than 2 weeks but less than 4 weeks (middle), and those who took more than 4 weeks (late). All patients completed the preoperative questionnaire. Of

the 96 participants, 75 (77.1%) completed all questionnaires and 89 (90.1%) completed at least 4 rounds of questionnaires.

Exposures

For CARE to be valuable and informative for establishing expectations for recovery, it will need to be sensitive to differences between patients and how they are treated. Thus, our exposures in this study can be broadly categorized as demographics, clinical characteristics, processes of care, and intermediate outcomes. Demographics consisted of age (<45 years, 45–60 years, >60 years), gender, race (white, non-white), marital status (married/living with a partner, not living with a partner), household income ($\leq$ \$50 000, >\$50 000), comorbidities (0 to 1, 2 or more), and support structure (adequate to poor, extensive). Clinical characteristics included treating surgical specialty (urology, gynecology, general surgery), procedure indicated for cancer treatment (yes/no), procedure indicated for treatment of pain (yes/no), procedure involving the intestines (yes/no), preoperative albumin (<4 g/dL, 4–4.3 g/dL, $\geq$ 4.4 g/dL), and hemoglobin at discharge from the hospital (<11 g/dL, 11–12 g/dL, >12 g/dL). Processes of care that were measured included surgical approach (laparoscopy, laparoscopy with conversion, conventional), use of parenteral nutrition (yes/no), admission to the intensive care unit (yes/no), and admission to hospital after surgery (yes/no). Intermediate outcomes included length of hospital stay (0, 1–6 days, >6 days), development of a postoperative complication (yes/no), and readmission to the hospital after surgery (yes/no).

Statistical Analysis

First, we evaluated the relationship between the time to recovery of baseline health (early, middle, and late) and each of our exposure variables using the χ^2 test. To quantify the magnitude of the relationship, we next fit a logistic model between each exposure and outcome (early recovery vs middle/late recovery). All analyses were performed using SAS software (v9.1.2, Cary, NC) and all testing was 2-sided and type 1 error was set at .05. The Institutional Review Board at the University of Michigan approved this study.

Results

Recovery of baseline health status was achieved by 35 (44%) patients within 2 weeks, 23 (28%) patients between 2 and 4 weeks, and 23 (28%) patients beyond 4 weeks. Table 1 illustrates the demographics of the study population by time to recover to baseline health after surgery. Generally, younger age, female gender, and living alone were associated with the earliest recovery to 90% of baseline health as measured by the CARE composite score. The strongest of these associations was age with an increasing likelihood of early recovery seen in each younger group. Only 21% of the oldest group reached baseline health status in 2 weeks or less, whereas 45% of the middle group and 60% of the youngest group achieved this mark. Women returned to baseline health early at nearly twice the rate of men (53% vs 32%), a relationship similar to that of patients not living with a partner, who achieved early recovery almost twice as quickly as those who were married/living with a partner (63% vs 35%). Surprisingly, recovery did not vary by comorbidity.

The relationships between clinical data, processes of care, and intermediate outcomes with time to recovery are presented in Table 2. On average, strong effects were seen for bowel surgery, cancer indication for surgery, and length of hospital stay. In fact, indications for bowel surgery had the strongest association with recovery, a finding that is in line with clinical experience. Patients not having surgery on their bowels were eight times more likely to be in the early recovery group with more than half of these patients present in this group compared with almost two-thirds of patients who had bowel surgery in the late recovery group (odds ratio [OR] = 8.0, 95% confidence interval [CI] = 1.7–37.8). Similarly, patients who underwent

surgery for malignancy experienced a slower recovery than those without a cancer indication for surgery (25% vs 59% early return, OR = 4.3, 95% CI = 1.7–11.4). Not surprisingly, patients undergoing inpatient surgery were 5 times less likely to have early recovery as those who had ambulatory surgery (33% vs 71%, OR = 0.20, 95% CI = 0.07–0.59). Several additional variables that are clinically associated with longer recovery time (intensive care unit stay, hospitalization of a week or more, and low hemoglobin at discharge) also displayed expected statistically significant relationships between recovery groups.

Discussion

In the last decade, an emphasis on faster patient recovery after surgery has been driven by technological advances in the operating room as well as managed care initiatives to cut hospital costs.⁹ For this reason, understanding the recovery process has important implications for patients and providers. In this study, we demonstrated that CARE is sensitive to a wide variety of constructs that are generally thought to influence recovery. For example, having bowel surgery is more likely to lead to a longer recovery whereas ambulatory surgery is associated with a shorter recovery. Although these findings are intuitive, the ability to objectively quantify such differences with a patient-reported questionnaire will ultimately help to inform preoperative discussions about expectations and the recovery process. Generally, the results of this study are consistent with clinical beliefs as to which factors influence recovery time and demonstrate the ability of CARE to be sensitive to such characteristics.

Patients exhibit wide variations in their expectations for and ability to recover from surgery. Because the process can be influenced by immutable qualities such as age and comorbidity,¹⁰ helping patients understand what others have experienced after surgery can provide appropriate benchmarks and facilitate discussions to set expectations preoperatively. Establishing appropriate expectations for recovery will help patients to understand the tradeoffs between alternative treatments and anticipate support needs for the process. Patients with a clear understanding of possible outcomes and realistic expectations have been shown to be more satisfied with their surgery.⁴ In this context, using CARE to better inform the stakeholders may ultimately lead to better patient satisfaction.

The implications for providers of using a generic quality of life instrument to measure recovery extend beyond the informed consent process and establishing reasonable expectations. Because CARE is discriminative to a variety of patient factors, it provides a framework for clinicians to objectively measure the effects of changes in the perioperative process (ie, change in surgical technique, adoption of a new technology). Previous studies examining relationships between process and recovery may have been limited by the insensitivity of the instruments to the pertinent constructs.¹¹ In this study, the robust relationships between recovery and clinical data in this heterogeneous population further illustrate CARE's ability to detect meaningful perturbations in the perioperative process. Such data are informative for clinicians as they provide objective feedback about the impact of change from usual practice to patient recovery.

Similarly, from a policy perspective, quantifying the recovery process can allow for broader issues in health care innovation and implementation to be addressed from a patient-centered perspective. As new technologies are introduced into an increasingly price-sensitive environment, measuring their effects on all facets of care will be important. Generic recovery can be combined with disease specific outcomes to determine the tradeoffs between costs and benefits that innovative technologies bring to society. Historically, some prominent clinical trials comparing laparoscopic and open surgery failed to show meaningful differences in general recovery even though laparoscopy was touted as being less morbid.^{12,13} These results highlight the need to accurately measure the value of new technologies, as the promise of improved convalescence may come with a substantial cost to implement.¹⁴ Technology that is

only marginally equivalent by traditional outcomes to standard techniques may still have an important role in the treatment of disease if it shown to greatly decrease convalescence or improve patient quality of life.¹⁵

Although we have shown that CARE is discriminatory to a wide variety of factors, we must acknowledge several limitations of this study. First, our study population is very heterogeneous in terms of the breadth of surgery between and within disciplines. Because of this heterogeneity, we introduce considerable statistical noise and inherently underestimate the actual magnitude of the relationships between our exposures and outcomes. Despite this limitation, we observed CARE's discrimination to several constructs that have face validity, including patient age, bowel surgery, and length of hospital stay. Second, our findings are also constrained by the relatively small sample size, which limits the statistical power. Many characteristics affecting recovery time, however, were identified within this group and more subtle processes of care impacting recovery will likely emerge as further populations are studied. In this respect, future work will focus on measuring recovery within large, homogeneous populations. Efforts will then be made to establish benchmarks for recovery and then evaluate the impact of process changes (ie, new surgical techniques, care paths) on short-term recovery times.

Conclusions

CARE uses generic measures of patient quality of life to determine return to baseline health after abdominal and pelvic surgery and in this study identifies a variety of patient characteristics, clinical characteristics, and process measures that are associated with recovery. CARE is discriminatory to several factors that have face validity in the recovery process and is useful for objectively measuring recovery after abdominal and pelvic surgery. Although professional observations and judgment will always be important in assessing patient outcomes, CARE allows for tenets of clinical wisdom to be tested, realistic patient expectations to be set, and the impact of changes in processes of care and new technology to be directly measured.

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Table 1

Demographic Characteristics of the Study Population According to Recovery Time

Characteristic	Stratum	Recovery to 90% of Baseline			Odds Ratio (95% Confidence Interval)	P Value
		≤ 2 Weeks (n = 35)	4 Weeks (n = 23)	>4 Weeks (n = 23)		
Age (%)	<45 years	15 (60.0)	6 (24.0)	4 (16.0)	5.6 (1.4–22.0)	.01
	45–60 years	16 (45.7)	10 (28.6)	9 (25.7)	3.2 (0.9–11.5)	
	> 60 years	4 (21.1)	7 (36.8)	8 (42.1)	1.0	
Gender (%)	Female	23 (53.5)	11 (25.6)	9 (20.9)	2.5 (1.0–6.2)	.04
	Male	12 (31.6)	12 (31.6)	14 (36.8)	1.0	
Race (%)	White	28 (40.0)	22 (31.4)	20 (28.6)	1.0	.17
	Non-white	7 (70.0)	1 (10.0)	2 (20.0)	3.5 (0.8–14.7)	
No. of comorbidities (%)	0 to 1	18 (40.9)	12 (27.3)	14 (31.8)	1.2 (0.5–3.0)	.50
	2 or more	17 (46.0)	11 (29.7)	9 (24.3)	1.0	
Marital status (%)	Married/living with a partner	20 (35.1)	18 (31.6)	19 (33.3)	1.0	.03
	Not living with a partner	15 (62.5)	5 (20.8)	4 (16.7)	3.1 (1.1–8.3)	
Household income (%)	≤\$50 000	16 (51.6)	9 (29.0)	6 (19.4)	1.9 (0.7–4.7)	.12
	>\$50 000	17 (36.2)	14 (29.8)	16 (34.0)	1.0	
Support structure (%)	Adequate to poor	11 (44.0)	8 (32.0)	6 (24.0)	1.1 (0.4–2.8)	.65
	Extensive	23 (41.8)	15 (27.3)	17 (30.9)	1.0	

Table 2
Clinical Data, Processes of Care, and Intermediate Outcomes According to Recovery Time

Characteristic	Stratum	Recovery to 90% of Baseline			Odds Ratio of Early Versus Middle/Late Recovery (95% Confidence Interval)	P Value
		≤2 weeks (n = 35)	4 weeks (n = 23)	>4 weeks (n = 23)		
Clinical data						
Treating specialty	Urology	7 (24.2)	11 (37.9)	11 (37.9)	1.0	.06
	Gynecology	19 (59.4)	8 (25.0)	5 (15.6)	2.5 (0.8–8.7)	
Cancer indication	General surgery	9 (45.0)	4 (20.0)	7 (35.0)	4.6 (1.5–13.9)	.01
	No	26 (59.0)	9 (20.5)	9 (20.5)	4.3 (1.7–11.4)	
	Yes	9 (25.0)	13 (36.1)	14 (38.9)	1.0	
Preoperative albumin	<4 g/dL	6 (35.3)	5 (29.4)	6 (35.3)	0.98 (0.22–4.3)	.80
	4–4.3 g/dL	5 (31.3)	5 (31.3)	6 (37.4)	0.82 (0.18–3.7)	
	≥4.4 g/dL	5 (35.7)	3 (21.4)	6 (42.9)	1.0	
Pain indication	No	26 (37.7)	21 (30.4)	22 (31.9)	0.2 (0.05–0.81)	.02
	Yes	9 (75.0)	2 (16.7)	1 (8.3)	1.0	
Bowel surgery	No	33 (51.6)	19 (29.7)	12 (18.7)	8.0 (1.7–37.8)	<.01
	Yes	2 (11.8)	4 (23.5)	11 (64.7)	1.0	
Hemoglobin at discharge	<11 g/dL	7 (30.4)	4 (17.4)	12 (52.2)	0.44 (0.13–1.5)	.05
	11–12 g/dL	7 (36.8)	5 (26.4)	7 (36.8)	0.58 (0.17–2.0)	
	>12 g/dL	11 (50.0)	8 (36.4)	3 (13.6)	1.0	
Processes of care						
Ambulatory surgery	No	20 (33.3)	17 (28.3)	23 (38.4)	0.20 (0.07–0.59)	<.01
	Yes	15 (71.4)	6 (28.6)	0	1.0	
Length of hospital stay	0	15 (71.4)	6 (28.6)	0	10.0 (2.1–48.6)	<.01
	1–6 days	17 (37.8)	13 (28.9)	15 (33.3)	2.4 (0.17–2.0)	
	>6 days	3 (20.0)	4 (26.7)	8 (53.3)	1.0	
Use of total parenteral nutrition	No	33 (44.6)	22 (29.7)	19 (25.7)	2.0 (0.37–11.0)	.15
	Yes	2 (28.6)	1 (14.3)	4 (57.1)	1.0	
Surgical approach	Laparoscopy	20 (54.1)	11 (29.7)	6 (16.2)	2.0 (0.80–5.0)	.09
	Laparoscopy with conversion	1 (16.7)	1 (16.7)	4 (66.6)	0.3 (0.04–3.2)	
	Conventional	14 (36.8)	11 (29.0)	13 (34.2)	1.0	
Intermediate outcomes						

Characteristic	Stratum	Recovery to 90% of Baseline				Odds Ratio of Early Versus Middle/Late Recovery (95% Confidence Interval)	P Value
		≤2 weeks (n = 35)	4 weeks (n = 23)	>4 weeks (n = 23)	16 (26.7)		
Postoperative complication	No	27 (45.0)	17 (28.3)	16 (26.7)	1.3 (0.48–3.7)	1.0	.52
	Yes	8 (38.1)	6 (28.6)	7 (33.3)			
Readmission to hospital	No	32 (43.8)	23 (31.5)	18 (24.7)	1.3 (0.29–5.9)	1.0	.16
	Yes	3 (37.5)	—	5 (62.5)			